

A Survey of Rex Breeding in China

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Introduction

Breeding is a long-term job needed in order to improve the breed of the rabbit flock and its production. The significance of breeding lies in that it can ameliorate the present quality of rabbit pelt, increase reproduction and reduce the cost of raising as well. There are more than 10 color-pattern Rexes in China. In recent years, many places successively began the Rex breeding in China. The following is a survey of Rex breeding in our country.

Direction of breeding and specific requirements

Breeding must have a correct direction, and to determine the direction, the following basic principles must be followed. It should adapt to the development of national economy and the demand of the international fur market; it should adapt to the local climate and the features of raising management; it should be able to maintain the good qualities of the original breed. In addition, we should also take into consideration of the following specific requirements.

1) Characteristic color: Rex is a typical pelt rabbit, now there are more than 20 natural color. When breeding all color Rex should be pure in color and pleasing in sheen, and stick to the original color pattern.

2) Quality of fur: Breeding Rex needs to be in fur thick, bright and even with the fur length between 1.2-1.3 cm. It should also have such features as erect, soft and spring, not easy to shed, and no sudden strays, it should also be stable in inheritance.

3) Features in build: The bred Rex should be well-proportioned in build, with a small head and a pointed mouth, round big eyes, fair-lengthed ears, strong limbs and quick in movement. Adult Rex should have an average weight of 3.2-3.5 kg, a length of 40-46 cm, and a chest measurement between 25-33 cm.

4) Reproduction: Doe produces 4 times a year with 6-7 each litter, and survival rate between 85-95%. Every buck can breed 8-10 females, and with a conception rate of 95% or more.

Color patterns and gene symbols

Rex has more than 20 color patterns, investigation shows that there are nearly 10 color-pattern REXs in our country. The following is a description of main color-patterns and their gene symbols.

1) Castor Rex (rr): The fur takes on a color of red-brown, tile-blue on the base fibre and dark orange or russet in middle and slight black on top.

2) Chinchilla Rex ($C^{ch} C^{ch} rr$): Dull tile-blue on the base, pearl-grey in the middle, on top black, and a little paler in the neck.

3) Chocolate Rex (aa bb rr): There's a basic agreement in the color, fur has a color of dark chocolate or dark brown, pearl-grey on the base.

4) Blue Rex (aa dd rr): It was a unanimous color, all blue from the top to the base, fine hair as goose down, very springy.

5) Havana Rex (aa bb rr): Thick soft fine hair, overall in chocolate color, with purple sheen, grey-blue on the base.

6) Black Rex (aa rr): Black fur rich in sheen, fine hair soft and thick. It has brown eyes and dim paws.

7) White Rex (cc rr): All white, short fine hair and soft thick, rich in sheen. It has red eyes, and white paws or yellowish pink.

8) Seal Rex ($C^{ch} C^{ch}$ rr): Dark brown or near black in saddle part, light color sides and stomach, whole fibre shows one color.

9) Sable Rex (aa $C^{ch} C^{ch}$ rr): Black-brown on the back, and gradually turns into brown on sides and limbs, neck and ears show purple-brown.

10) Lilac Rex (aa bb dd rr): All in one color of lilac, rich in sheen, fine hair soft, close and thick, and sapphire eyes.

11) Himalayas Rex ($C^H C^H$ rr): Fur short, close and soft, white in color, and rich in sheen, black on nose, ears, bottom part of limbs and tail, so it is also called eight-point-black.

12) Light yellow Rex ($a^t a^t$ dd ee rr): It has a color of light yellow, darker on the back, near yellowish brown, fine hair soft and close.

13) Reddish Brown Rex (ee rr): In one color of slight reddish brown fine hair soft and close, brown eyes and paws in dim color.

14) Blue-grey Rex (dd rr): Fur in blue-grey color, darker on the back, fine hair short and close and soft, tile-grey eyes, and paws in dim color.

Moreover, in practical production, there are still many rexes of other color patterns, such as Orange Rex (bb rr), Lynx Rex (bb dd rr), Steel-grey Rex ($E^b E^b$ rr), Black-brown Rex ($a^t a^t$ rr) and Silver Leopard Rex ($a^t a^t C^{ch} C^{ch}$ rr) and Yellowish-brown Rex ($a^t a^t$ ee rr) and so on.

Breeding methods and specific measures

Breeding, according to different aims, can roughly be divided into pure-breeding and crossbreeding.

1) Pure-breeding.

Rex was originated in France, and was bred from a mutation in regular rabbit flock. In recent years, it was introduced into Zhejiang, Beijing, Sichuan, Heilongjiang, etc. successively.

In order to keep the bred and improve the high quality, we should adopt pure-breeding among those stud rexes coming from abroad or other places in China.

The so called pure-breeding refer to the reproduction and selection in one bred or one strain. In one fine bred, the gene frequency of the good properties remain higher in that colory. Pure-breeding and selection can keep and improve this gene frequency, at the same time reduce the gene frequency of bad properties. Otherwise, the random flow, mutation and natural selection of the gene frequency will lead to the debase of good properties and degeneration of the bred.

In pure-breeding, we should first set up kernel flocks for the stud rexes which are introduced from elsewhere or abroad after careful consideration, by concentration raising, set up comparatively centralized fine breed farm majoring in fine-bred reproduction. These fine breed selection and appraisal procedures. It has been proved by real production that: the stability of each breed is comparative, and there is no complete agreement in heredity among individuals, in particular, not all of them are apt to be studs. So we must strictly devided them into breed use and economic use according to individual properies. Only those which are clear in origin, qualified in properties and grade are to keep for breed use, And in order to maintain the breed value, breeding among one strain is adopted, to prevent the decline in viability of the future generations. In the process of concentration raising, we should make detailed recording of the requirements in raising management of the introduced breed, study the characteristics of its growth, reproduction, hatits, physical reactions and so on. Try to improve the raising management so as to make possible the rapid spread of there breed under the normal sicientific conditions.

2) Cross breeding.

Rex as compared to regular rabbit, is recessive in inheritance, that is when rex cross breeds with regular rabbit, the 1st generation all have the regular fur of the rabbit. Then interbreed the 1st generation, it is among the 2nd generation that there is possible occurance of rex. The proportion is 3:1.

If we choose two individuals to cross breed, the color patterns of which are controled by two pairs of genes respectively,

there may occur a gene combination of $4 \times 4 = 16$. For instance, Castor Rex (rr) cross breed with Chinchilla rabbit, 1st generation will all be Chinchilla. After interbreeding the 2nd generation may have grey rabbit, Chinchilla rabbit, and Castor Rex with a proportion of 9:3:3:1. There are 4 possibilities and the proportion is exactly the square of 3:1.

patterns. For example, Castor rex (rr) cross breeds with Havana rabbit (aa bb), the 2nd generation may have grey rabbit, Cassia rabbit, Black rabbit, Havana rabbit, Castor Rex, Cassia Rex, Black Rex and Havana Rex with the proportion by 27:9:9:9:9:3:3:1 exactly the cubic of 3:1. Among them the proportion of regular fur breed (48) and short fur (16) is still 3:1.

If more gene pairs are concerned, so long as these genes which control the relative characters are distributed individually, we can calculate according to the 3:1 'Equation of inheritance characters transmission' (Table 1), here 'n' refers to the number of relative characters.

Table 1. The inheritance of different pairs of genes under complete dominance

gene pairs	F ₂ phenotype	F ₂ genotype	F ₁ Gamete	F ₁ Gametophyte	proportion
1	2	3	2	4	(3:1)
2	4	9	4	16	(3:1) ²
3	8	29	8	64	(3:1) ³
4	16	81	16	256	(3:1) ⁴
:	:	:	:	:	:
:	:	:	:	:	:
n	2n	3n	2n	4n	(3:1) ⁿ

However, it must be pointed out that there is character separation under the control of two or more pairs of genes. In many cross breeding experiments, because of the interaction of genes, there also occurred the change in proportion, the progenies of cross breeding may produce more complexed and different-numbered types.

3) Breed selection measure. In the process of Rex breed selection, a summary of experience from all parts of the country

shows that such measures should be adopted:

a) Breed recording. In order to develop rex breed selection with goals and plans, every rabbit farm should make detailed recording of breed selection and statistics for this is the basis of improving work, summarizing experience, finding problems and developing systematic breed selection. The contents of recording should include data of length, weight, reproduction properties and all kinds of appraisal results. Stud rabbits should be numbered in order to conveniently distinct and make recording. The proper part for number in inside ear, time should be between the weaning of new-born rabbits, and ear-size pincers should be employed.

b) Scientific raising. The mutation in short fur of rex is sometimes accompanied with metabolic hiderance, specifically shown in the relatively high requirement in raising conditions, small in birth weight, and high in death rate. So scientific raising should be developed for the convenience of breed selection. It is reported that grown up rabbit with a weight of 3 kg should have in its diet digestible energy 2500-2900 Cal./per kg. The proper protein amount rex needs in diet during the period of growth, maintain, pergnancy and milking should be 16%, 2%, 15% and 17% respectively, Table II.

Table II. Diet of Rex

feeds	amount (%)	protein (%)	digestible nutrients (%)	C _a (%)	P (%)	crude fat (%)	fiber (%)	Vitamin A (mg/kg)
alfalfa hay	45.0	7.88	22.50	0.599	0.104	1.08	11.21	0.99
Corn	28.5	2.65	23.66	0.009	0.080	1.11	0.57	
barley	11.0	1.05	8.25	0.004	0.037	0.21	0.68	
wheat bran	5.0	0.76	2.85	0.006	0.002	0.21	0.52	0.13
soybean cake	10.0	4.61	8.20	0.028	0.062	0.10	0.58	0.002
salt	0.5							
total	100.0	16.95	65.45	0.646	0.285	2.71	13.56	1.122

c) Spread gradually. Newly introduced stud rabbits from abroad or other areas should be raised in concentrated ways, and in the course of raising, careful watches should be made on the special properties of the breed along with careful studies on the growth, reproduction, habits and physical reactions etc... After a period of local domestication and breed selection, gradually extend them to the reise in production units. However, in doing this, we should avoid development without plan and purposes. Importance should be laid not only on breed and number but also on breeding and quality.